done the work. The phenomenon swept on across the country out of sight."

Passing within half a mile of Waxhaw, the storm did no damage there, but seems to have been at its greatest intensity 2½ miles northeast of that place, in what is called the Howie Gold Mine district.

Here the home of B. P. Hancock was completely destroyed, and one of the children, Ella Hancock, seriously injured by flying timbers. The other members of the family sustained minor injuries. Two tenant houses in this vicinity were wrecked, one of which was occupied by Raymond Paxton and his family. That no one was injured is probably due to Mr. Paxton's precaution in taking his family to a deep road ditch, in which they lay flat.

At the Howie mine a negro cabin was demolished, the occupants having taken refuge in an old mine shaft. The old mill house was blown down on five mules, one of which was killed and others injured. A yearling heifer was also killed. Large oak trees were twisted and torn out by the roots, the tramway from the shaft to the mill house was wrecked, and roofs and chimneys of other buildings were blown off.

From the Howie mine the tornado continued northeastward for about 4 miles through a sparsely settled district, apparently coming to an end near Wesleys Chapel, which is 8 miles southwest of the place where the April tornado began.

The following descriptions of weather conditions attending the movement of this tornado have been received:

From Lewis L. King, postmaster at Waxhaw, N. C.:

"I saw the tornado that passed this town on Sunday, June 20, 1920, from beginning to end. It was a typical summer day, warm, with thunder clouds passing over. A heavy thunder cloud had passed to the north of us, going northeast, a few minutes before the black funnel-shaped cloud appeared, but there was just a light rain in the cloud that passed before the tornado and not much rain in the tornado cloud. There was a mighty roar, somewhat like the roar of a train, and some people actually mistook the noise for a passing train and did not see the tornado. I would say that the path of the storm was not over 200 feet. There was no thunder in the tornado cloud. This was a genuine twister, which suddenly dipped down and was exactly in the shape of a funnel."

From B. P. Hancock, living 2½ miles northeast of Waxhaw, whose home was completely demolished:

"The forenoon was very hot, with a few showers. About 1:30 a small cloud formed in the southwest, moving southeast, and about 20 minutes later another small cloud formed in the northwest, moving toward the northeast, from which thunder was heard three times. After the third thunder it seemed to move back to the southwest, forming into a body like a thunderhead and an awl at the same time. At times it fell to the earth and then rose back up again, and soon formed into a funnel shape, broad at the top and narrow at the bottom. This descended down again and it began to roar and move from the southwest to the northeast. It was dark in the storm as night, but there was no thunder, rain, or hail; there seemed to be a lot of heat inside it."

It is interesting to note that both of these accounts describe the weather as "warm" and "very hot," whereas in Charlotte it was rather cool in the forenoon, the temperature ranging from 62 to 65 up to 11 a. m., when it began to rise, reaching a maximum of 78 at 4 p. m. Cool weather prevailed generally throughout the State, the maxima in the central district ranging from 65 at Winston-Salem to 80 at Albemarle. Monroe, about 10 miles east of the tornado path, had the highest maximum, viz, 83. The heat area mentioned in the above accounts was, therefore, purely local.

There was a thunderstorm in Charlotte from 5:05 p. m. to 6:22 p. m., and frequent showers occurred during the day, the total amount being 1.11 inches. One of these showers occurred from 1:05 p. m. to 1:50 p. m.; amount, 0.31 inch.

Monroe reported a rainfall of 0.62 for the day.—*G. S. Lindgren, Weather Bureau Office, Charlotte, N. C.*

TORNADO IN SOUTHEASTERN WYOMING, JUNE 24, 1920.

The Weather Bureau official at Cheyenne, Wyo., has reported the occurrence of a small tornado, accompanied by a severe hailstorm in southeastern Wyoming on the afternoon of June 24. As far as can be learned, the damage was very slight. The tornado swept a path about 200 feet wide and about 12 miles long in the vicinity of Hillsdale and Burns. A few houses, barns, and fences were destroyed, but there was very little damage to stock and no deaths were reported.

The hailstones were unusually large and destructive. Several newspapers contain accounts of hail "as large as good-sized lemons," "medium-sized hen's eggs," English walnuts, and one report from Burns said the hailstones were about 7 inches in circumference. The force of the hail was sufficient to dent the steel roof of railway coaches and did considerable damage to tin roofs. On the whole, however, the storm was not severe, although in appearance it was said by some former residents of the Missouri valley to be a "regular, old-time Missouri twister."—*C. L. M.*

COLD SHORE WATER OWING TO OFF-SHORE WINDS.

By CHARLES F. BROOKS, *Meteorologist.*

[Weather Bureau, Washington, D. C., July 28, 1920.]

Reports of unusually cold surf bathing along the New Jersey coast late in July, 1920, led me to examine the wind records of Sandy Hook and Atlantic City. Although there had just been a decidedly cool spell, with northerly winds, and although the spring and early summer averaged 2° or 3° F. below normal in eastern New Jersey, it did not appear that these influences would be sufficient to make the coldness of the water worthy of remark. An unusual amount of off-shore wind, however, would easily account for cold water, because such winds would have driven the warmed surface water out to sea, and cold water from below would have replaced it.

In June, 1920, the off-shore winds—SW., W., NW., and N.—at Sandy Hook blew a total of 4,778 miles, as compared with 2,260 in 1919, and 5,148 in 1918. It is noteworthy that these winds in June, 1920, comprised 54 per cent of all the wind of that month, and that this is not only markedly greater than the 26 per cent of off-shore winds in June, 1919, but also exceeds the off-shore winds of June, 1918, which were 49 per cent of the total—less than half, in spite of the large amount, June, 1918, being unusually windy.

At Atlantic City the average (1914–1920) frequency of off-shore winds, SW., W., NW., and N., at the 8 a. m. and 8 p. m. observations in June is 28, i. e., 47 per cent. In June, 1920, however, the number was 38, or 63 per cent of the total. In July the average frequency of off-shore winds is 34 (31 for 28 days), or 57 per cent, while in the first 28 days in July, 1920, the number of off-shore wind occurrences was 37, or 66 per cent. Thus, in June and most of July this year the off-shore winds have been 27 per cent more frequent than the average of the last seven years, and have occurred about two-thirds of the time. Not since 1912, when the off-shore winds of June and July were 26 per cent more than the average, has there been even as much as 10 per cent more than the usual frequency of off-shore winds in June and July combined. In June and July, 1919, the on-shore winds, NE., E., SE., and S., were 26 per cent more than the average frequency.

In view of the very unusual frequency and preponderance of off-shore winds on the New Jersey coast during the past two months, it seems reasonable to ascribe the reported coldness of the water to their action in blowing the warm water out to sea.

Addendum (Aug. 13).—A letter recently received from Mr. W. H. Culliman, of the Boston Globe, states that "The temperature of the water at New England beaches [Massachusetts particularly] has been consistently about 10 degrees below normal this season, according to reports from the State bathhouses." As in the case of the New Jersey coast, though to a greater degree in New England, the water probably has been colder than normal since the cold weather of last winter. Add to this the effect of a reduced amount of warming in June, owing to 25 per cent more than normal cloudiness at Boston (19 per cent excess at Nantucket), and we have the cold water partly explained.

The unusually persistent offshore winds (i. e., SW. to N.) have blown even the moderately warmed surface water out to sea and cold water has welled up from below to take its place. Wind data for Boston and Nantucket, tabulated with the help of Mr. Herbert Lyman, show that in June and July this year there was 10 per cent more offshore wind than in the corresponding period of last year. At Boston 74 per cent of all the wind in these two months was offshore (69 per cent last year), and in July alone 83 per cent—6,081 miles of wind went out to sea and only 1,248 miles came in.

Thus, cold water in spring, warmed moderately in early summer and then largely blown out to sea, has left for bathers the still colder ocean water creeping up from the depths of the Labrador current.

NOTES, ABSTRACTS, AND REVIEWS.

THE BLUE SKY AND THE OPTICAL PROPERTIES OF AIR.

By the Right Hon. LORD RAYLEIGH.

(Abstracted from Nature, vol. 105, pp. 584–588, July 8, 1920.)

The late Lord Rayleigh, from his demonstration that upon the basis of either the elastic-solid or the electromagnetic theory a cloud of small particles (individually minute relative to the wave-length) is capable of scattering incident light in every direction, the scattered light being preponderately blue and completely polarized in a direction at right angles to the source, was led to the conclusion that the air molecules alone were capable of accounting for much, if not all, of the blue light of the sky. Tyndall's experiments upon the disappearance of the path of a beam of light when the motes were removed by filtering through packed cotton-wool or by being consumed in the flame of a Bunsen burner under the beam seemed to refute this. The present Lord Rayleigh, however, has shown, by visual, photographic, and spectroscopic observations, that the path of a beam through dust-free air (and there is no trouble about removing all the dust—dust so fine as to be very difficult of filtration is an armchair conception not encountered in practical experimenting), when *observed transversely against* a sufficiently black background (e. g., the mouth of a deep cave) to get rid of stray light, is distinctly visible, and blue. It seems to appear to be of other colors, e. g., lavender, to some people because, probably, of a peculiarity of color vision with faint light.

Observation has, however, detected for each gas a characteristic departure (4 per cent for pure air) of the scattered light from complete polarization. Theory shows that this must be due to nonsphericity of the molecules; hence such experiments may furnish material for the investigation of molecular and atomic structure.

Rayleigh and Babcock have found, by means of the Savart polariscope, that the light from the night sky shows only a trace of polarization, and hence can not be due to light from an attenuated atmosphere so high as to be outside the earth's shadow.[1]

In 1917, Rayleigh (then Prof. Strutt) and Fowler discovered that the limited extension of the solar spectrum into the ultra-violet was due to absorption bands (previously undetected because of their diffuseness and the superposition of numerous metallic lines) identical with those observed at the limit of the spectrum of Sirius by Huggins in 1890, and identical with bands in the spectrum of burning magnesium when observed through a tube containing ozone. The solar spectrum has a greater extension in the ultra-violet with a high sun than with a low sun. Of oxygen, nitrogen, carbon dioxide, water vapor and argon, none appreciably absorbs ultra-violet rays in the region where the solar spectrum ends; and the spectrum of a mercury-vapor lamp observed 4 miles away, so that the air mass was equal to that above the Peak of Teneriffe where solar spectrum observations have been made, showed no evidence whatever of ozone absorption.

"What conclusion can we draw? Evidently that the absorbent layer of ozone in the air is high up, and that there is little or none near the ground. It may seem at first sight that this thin and inaccessible layer of ozone, which we have learned of by a chain of reasoning not less conclusive than direct observation, is a matter of little importance to man and his welfare. There could be no greater mistake. It acts as a screen to protect us from the ultra-violet rays of the sun, which without such a protection would probably be fatal to our eyesight: At least if one may judge from the painful results of even a short exposure to such rays, which those who have experienced it are not likely to forget."—*E. W. W.*[2]

[1] See H. D. Babcock, Note on the polarization of the north sky, Astrophys. Jour., 50, 228–231, 1919.—*E. W. W.*

[2] It may be pointed out that if the absorptive layer of ozone did not exist, the course of organic evolution during the geologic ages would have been such that the resulting organisms whould have been adapted to withstand the ultra-violet radiations.—*E. W. Woolard.*

THE LIGHT FROM THE SKY.

The color of the cloudless sky, though generally blue, may, according to circumstances, be anything within the range of the spectrum. The early attempts to account for the blue of the sky were mere speculations; the first logical attempt was that of Newton, but it was erroneous, and criticized by others.[1] The discoveries of

[1] See W. J. Humphreys, Optics of the Air, Jour. Frank. Inst., November, 1919, p. 657 et seq.